Fall 9-1944

Volume 55 - Issue 2 - September, 1944

Rose Technic Staff
Rose-Hulman Institute of Technology

ROSE TECHNIC

ROSE POLYTECHNIC INSTITUTE
LABOR ET SCIENTIA
1874

SEPTEMBER, 1944

MEMBER ENGINEERING COLLEGE MAGAZINES ASSOCIATED

KEEPING UP WITH

Electricity

BUMPLESS RIDES in trains and automobiles are forecast, because of a new-type stabilizer. Present job of the stabilizer is to make it possible for American tanks to fire with deadly accuracy, even when traveling at full speed over rough terrain. No details until after the war, but it is another of the many Westinghouse wartime developments with peacetime applications.

LIGHTNING UMBRELLA. A wire stretched over the top of a building, then grounded, forms a better protection against lightning than the old-time lightning rod, the Westinghouse High-Voltage Laboratory finds. Effect is like an umbrella, keeping the bolt entirely away from buildings where even the slightest spark might be dangerous.

THIMBLEFUL OF RECTIFICATION. Copper-oxide rectifiers are usually associated with high-current applications, but one type used in high-frequency instruments is rated at one milliampere—at one volt. It is 3/32 of an inch in diameter; a bank of four in their Micarta housing can be covered by a thimble.

OUTDOING THE LAC BUG—Shellac is produced by an Asiatic insect familiarly known as the lac bug. When the greater part of the world's population of lac bugs fell into enemy hands, this important plastic was cut off from us. Westinghouse research men then created synthetic molecules almost identical with the molecules of shellac. This new material is an even better shellac for many uses than shellac itself.

• • •

Let us send you a free copy of the new booklet, "Books by Westinghouse Authors." Titles listed are not only in the fields of Electricity and Electronics—many of them standard texts—but also cover a wide variety of other subjects, from Astronomy to Sales Engineering. Ask for booklet RT 94.

Handcuffs for escaping carbon

Airplane propeller speed-reducing gears must be *tough and strong* to withstand the terrific punishment of long flights over enemy territory.

Westinghouse research engineers have found a way of toughening these gears so that *their former life expectancy is doubled.*

These engineers developed a process of heat-treating the gears in an *Endogas** atmosphere that prevents the escape of carbon from the steel parts.

Ordinarily, in a heat-treating furnace, the carbon-hungry oxygen actually *devours the carbon* on the outer skin of the steel, softening the surface and depositing a layer of scale.

In a furnace employing an Endogas atmosphere, any carbon which may escape from the steel is instantly replaced. The carbon content is undisturbed. Furthermore, no scale is formed—thus reducing, and in some instances, completely eliminating the cost of finish machining of Endogas-treated parts.

Another example of how Westinghouse research helps America outproduce all the Axis powers combined! Westinghouse Electric & Manufacturing Company, Pittsburgh 30, Pennsylvania.

*Trademark Reg. U. S. Pat. Off.

WESTINGHOUSE PRESENTS: *John Charles Thomas, Sunday 2:30, EWT, NBC.*
Ted Malone, Monday, Wednesday, Friday, 10:15 pm, EWT, Blue Network

Westinghouse

PLANTS IN 25 CITIES — OFFICES EVERYWHERE

ROSE TECHNIC

VOLUME LV SEPTEMBER, 1944 NUMBER 2

STAFF

Robert G. Gillum .... Editor-in-Chief
John R. White .... Business Manager
John W. Murdock .... Associate Editor
E. James Hegarty .... Advertising Manager
Charles A. Stringfellow .... Circulation Manager
J. Prewitt Wehle .... Photography Editor
Charles H. Eanes .... Staff Photographer
C. Gordon Hayes .... Campus Editor
John R. Lee .... Humor Editor
Howard P. Freers .... Alumni Editor
Keith A. Sutton .... Research & Development
Charles Bashe .... Contributing Staff
Robert E. Logsdon .... Contributing Staff
Fred C. Maienschein .... Contributing Staff
Marion C. Beadling .... Circulation Staff
Jack L. MacLaren .... Circulation Staff
John R. Ott .... Circulation Staff
Lubo Chelich .... Advertising Staff
C. Max Duggins .... Advertising Staff
Joseph B. Durra .... Advertising Staff
Arnold M. Hannum .... Advertising Staff

FACULTY ADVISER
John L. Bloxsome

COVER—

Civil's-eye view of a civil. Bob Stallman, sr., c.e.
—Photo by Wehle and Eanes

FRONTISPIECE—

DEATH FOR THE AXIS—*This assembly with a twin message of death for the Axis swings into place on the production line at the U. S. Naval Ordnance Plant operated by the Westinghouse Electric and Manufacturing Company at Louisville, Kentucky. The two five-inch guns shown here mounted on a single base were designed for both anti-aircraft and surface action, and will soon be ready for sea duty. In the battle of Salerno similar weapons put on a spectacular demonstration of accuracy, smashing enemy tanks from six miles away. In the South Pacific they have taken a heavy toll of Jap planes and shipping.* —*Cut courtesy Westinghouse*

TABLE OF CONTENTS

ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Chairman, John W. Ramsey, Tennessee Eastman Corporation, Oak Ridge, Tennessee.

Advertising Representative, Littell-Murray-Barnhill, Inc.
101 Park Avenue, New York.
605 N. Michigan Ave., Chicago.

Arkansas Engineer
Colorado Engineer
Cornell Engineer
Illinois Technograph
Iowa Engineer
Iowa Transit
Kansas State Engineer
Marquette Engineer
Michigan Technic
Minnesota Techno-Log
Missouri Shamrock
Nebraska Blue Print
N. Y. U. Quadrangle
Ohio State Engineer
Oklahoma State Engineer
Pennsylvania Triangle
Purdue Engineer
Rose Technic
Tech Engineering News
Wayne Engineer
Wisconsin Engineer

Published Monthly except June and July by the Students and Alumni of Rose Polytechnic Institute. This publishing schedule is subject to change due to war conditions.

SUBSCRIPTION, $2.00 PER 8 ISSUES. ADDRESS ALL COMMUNICATIONS TO THE ROSE TECHNIC, TERRE HAUTE, INDIANA. ENTERED IN THE POST-OFFICE AT TERRE HAUTE AS SECOND-CLASS MATTER, AS A MONTHLY DURING THE SCHOOL YEAR, UNDER THE ACT OF MARCH 3, 1879. ACCEPTANCE FOR MAILING AT SPECIAL RATE OF POSTAGE PROVIDED FOR IN SECTION 1103, ACT OF OCTOBER 3, 1917, AUTHORIZED DECEMBER 13, 1918.

An Editorial - -

For the second time in less than half a century, the peoples of the world are emerging from a storm. As we entered into the first, only to emerge after four years for a brief respite, Sir Arthur Conan Doyle penned words which are the pith of the hopes we all shelter from our lesser passions. "There's an east wind coming . . . such a wind as never blew on us yet. It will be cold and bitter, and a good many of us may wither before its blast. But its God's own wind none the less, and a cleaner, better, stronger land will be in the sunshine when the storm has cleared." It is true that that wind was cold and bitter and many did wither before its blast, but a better world did not lie in the sunshine. On the contrary, a cheaper, more evil, and weaker world lay under clouds of impending war. Now we are again looking for the world anticipated by Doyle and we are looking to our fathers, our leaders, and our teachers to give it to us.

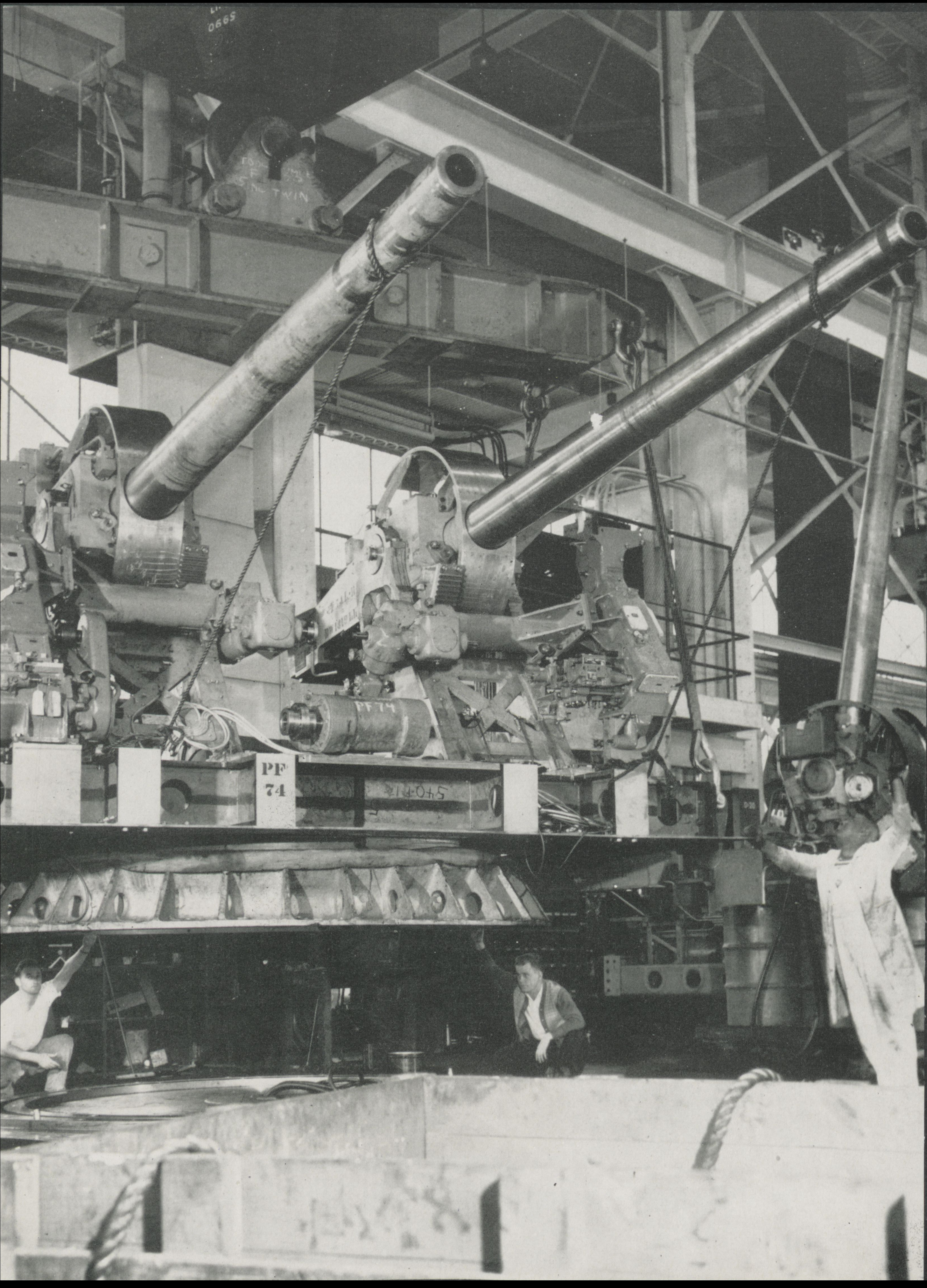
It may amuse our elders to see the younger generation openly look to them for help, as such practice in their eyes, due no doubt, to assumed airs of youth, is considered to be in general disregard. Yet despite such an obvious defensive, and somewhat belligerent attitude, we are none the less dependent on our instructors for the creation of a cleaner world in which we may develop normally and peacefully to that age when we may look at rising generations with the same, unchanging attitude of superiority mingled with scepticism and mild amazement.

With due apologies, we are asking for assistance, and guidance, for the benefit of the experience and the wisdom of age in our preparations for good citizenship. We realize, and we hope our fathers do, that we are at a crossroad. It we take the wrong fork it is wholly probable that we shall, in another two decades, be faced with another storm and mere hopes for a better world in the "future." It is doubtlessly true that we shall arrive at that point if we disregard, or are not given, the counsel and advice for which we ask. We cannot be ignored nor regarded as incidental or superfluous in this crisis, for "we, not you, shall pay the cost for battles you, not we, have lost." It is totally within the powers of our fathers to give to us a world in which we may live without fear of want or war. It is not asking too much to ask them to do so.

To give to us what we are asking, and to train us to maintain it will require a closer unity between "teacher" and "pupil". This aim cannot be achieved unless there is a closer understanding between age and youth and a greater appreciation of the problems of each. It is obvious that the problems of age are of great consequence while it has generally been considered that those of youth are transitory or worthy of but little consideration. The fallacy of such thought is now apparent when we are dangerously close to taking the wrong fork at the crossroads.

The mere completion of the task of making us accredited engineers, or doctors, or lawyers, is not necessarily the end of age's responsibility to youth. How we perform when faced with problems requiring judgment and understanding will be the test of the adequate counsel and the indication of a fulfilled or neglected duty to us. We should not be found wanting. Once again we ask for the assistance and aid necessary to produce the "better, cleaner, stronger world which will lie in the sunshine after the storm has cleared."

John W. Murdock


PF
74

Recovery of Carbon Dioxide

By ROBERT E. LOGSDON, soph., ch.e.

Called by some the "war gas number one," carbon dioxide is coming into its own right as a result of the war. Here Mr. Logsdon presents some of the facts behind its amazing career in recent years.

Since the beginning of the war, the uses of carbon dioxide have multiplied ten-fold; and certain authorities have even gone as far as to call it "war gas number one". The expansion of the carbon dioxide industry has been amazing, and there is no reason why production should be greatly curtailed when peace comes. The main emphases will probably be placed upon new methods of recovery from industrial flue gases and upon the lowering of production costs.

Before the twentieth century a large percentage of the carbon dioxide that was used commercially was obtained from natural wells or from mines and pits. The carbon dioxide works at Herste near Dribury in Westfalen supplied Germany with half of her total consumption. This gas was 99.84 per cent pure and needed no further purification. Because of the large demand, most of the carbon dioxide used now is prepared from flue gases having as little as 10-15 per cent carbon dioxide.

The largest amount of carbon dioxide produced today is probably recovered from lime and cement kilns and flue gases produced by burning high grade coke. Almost any gas containing a sufficient concentration of carbon dioxide will do, however, if reasonably free from sulfur dioxide and gaseous hycarbons. Attempts to recover carbon dioxide commercially from flue gases produced by burning coal have, in general, been proved uneconomical.

The present day recovery of carbon dioxide is based upon the fact that certain acidic gases such as carbon dioxide are absorbed at suitable temperatures by certain inorganic compounds such as alkali carbonates. The mixture is then heated to around 212° F., and the absorbed carbon dioxide is liberated.

The process in general consists of the following steps: (1) Production of a gas containing carbon dioxide. (2) Purification by washing. (3) Absorption in alkali "lye" or slurry. (4) Liberation of pure carbon dioxide from "lye" by heating. (5) Dehydration, compression, and condensation of gas to liquid or solid.

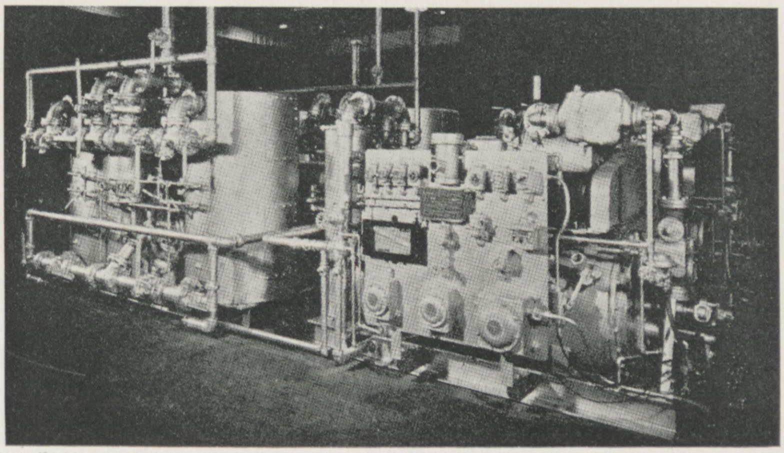
There are two standard methods used in this country for manufacturing carbon dioxide—the standard absorption process and the Reich absorption process. The standard absorption process is most widely used, but the Reich process is swiftly supplanting it. One reason for this is that the standard process requires 0.85-1.25 tons of high grade coke per ton of manufactured carbon dioxide.

The furnace and boiler equipment in a carbon dioxide plant is very similar to that found in other industrial power stations. Many plants still use hand fired furnaces, but these are rapidly being replaced by stoker fired furnaces. It requires around 7 pounds of foundry coke per square foot of grate space per hour.

After being collected, the flue gas used in the process (17-40 per cent carbon dioxide) is first sent to the scrubbers for purification. The scrubber is usually a steel, wood or concrete tower packed with small pieces of limestone. Over the packing water is spread, and the flue gas is blown up through the packing. Here the dust is removed by the water, and 80-90 per cent of the sulfur dioxide is converted into sulfurous acid. $SO_2 + H_2O \rightarrow H_2SO_3$. The remaining sulfur dioxide passes into the absorber where it reacts with the alkaline slurry, decreasing the efficiency. A number of carbon dioxide plants now use a dilute solution of sodium carbonate in their scrubbers, thereby decreasing the amount of sulfur dioxide passing into the absorbing towers. The scrubbed gas is fairly free from dust and sulfur dioxide; therefore it is next passed into the absorbers.

In the standard absorption process the concentration of carbon dioxide in this gas is preferably 17 per cent or higher. The absorbers are coke-packed towers about 10 feet in diameter and 100 feet high, over which an alkali carbonate or "lye" is circulated. The flue gas is pumped in the bottom of these towers and circulated up through the absorbent (sodium or potassium carbonate or both).

(*Continued on Page* 23)



Kemp Gas Dehydrator.

Courtesy C. M. Kemp Co.

The Photoelectric Cell

By CHARLES BASHE, soph., e.e.

At almost any scientific exhibition the instrument which attracts the most attention is the photoelectric cell, with its ability to perform mystifying tricks with exact precision. The photoelectric cell has its practical uses in industry, however, and these are the topic of Mr. Bashe's discussion.

Modern industry is employing photoelectric cells of various kinds on such a tremendous scale that most of us no longer consider them mysterious devices possessing uncanny powers. Very few people, however, realize the simplicity of the principle which gives these instruments the ability to detect light, and even to imitate the human eye.

It is convenient to divide the various photosensitive cells into three distinct classes: photoelectric cells, photoconductive cells, and photovoltaic cells. The photoelectric cell contains a metal anode and a cathode coated with a photosensitive material. When light strikes the cathode, electrons are emitted from it and, aided by an impressed voltage, travel to the anode, and thence to the external circuit. The photoconductive cell is essentially a conductor whose resistance to an electric current changes as light of varying intensities strikes it. The photovoltaic cell consists of two dissimilar electrodes which are in mutual contact with a third material. When one of the electrodes is struck by light, a current flows in the cell.

The photoelectric cell has proved more applicable to industrial use than have the other types of photosensitive cells. It responds instantly to rapid changes of light intensity and is activated by light over a great range of frequencies, while the photoconductive cell is very slow to respond, and use of the photovoltaic cell is confined to cases where visible light is involved.

Photoelectric Emission

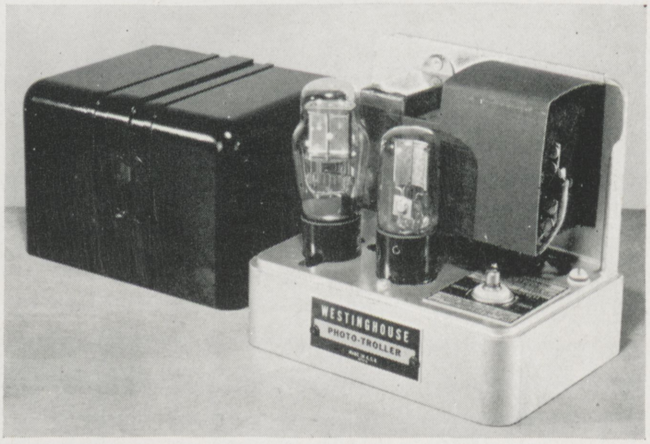
For the full story of the photoelectric cell, we must go back to the year 1887. The German physicist Hertz first noticed that the passage of an electric discharge was facilitated when light from another electric spark fell upon the cathode, or negative electrode. Since the cathode charge consists of an over-abundance of electrons, it appeared that energy from the nearby spark caused the electrons to leap from one electrode to the other. Hertz noted also that no effect could be observed if only the anode, or positive electrode, was illuminated. His results led to a great deal of experimentation with the photoelectric effect. Hallwachs, another German, charged a polished zinc plate with negative electricity and illuminated it with light from a carbon arc. The entire charge was lost in a short time. He found that if a glass screen was placed between the carbon arc and the zinc plate the effect was destroyed. This experiment merely indicated that ultra-violet light, which will not penetrate glass, was required in this particular case. It is significant that in Hallwachs' experiment, as in that of Hertz, light radiations had no effect upon a positively charged body.

In the last decade of the nineteenth century, Elster and Geitel took the lead in experimenting upon the subject of photoelectric emission. They worked with substances which, unlike the charged plate of Hallwachs, possessed an inherent sensitivity to light radiations. As has been stated, early experimenters had found ultra-violet radiations essential to photoelectric emission. Elster and Geitel showed that certain of the so-called alkali metals, such as potassium and sodium, are effected by *visible* light in such a way as to lose electrons. It is to be noted that, in the case of these photosensitive metals, the emitted electrons come out of the material itself, whereas in previous experiments it had been necessary to charge electrically the object being tested.

The Fundamental Theory

One of the modern theories of light depends upon the assumption that radiant energy is composed of minute particles, or quanta, of energy, rather than a continuous flow. This theory, called the quantum theory, was originated by Planck, and explains the phenomenon of photoelectric emission more clearly than does the wave theory.

According to the quantum theory, the velocity of light is constant. It is equal to the product of the wave length of light of a given color by the frequency of the same kind of light. Thus, light of very short wave length (e.g., ultra-violet light) has a very high frequency, while long-wave light has a low frequency. According to Planck's theory, the energy contained in the quanta of light of a given wave length is equal to a constant multiplied by the fre-



Inexpensive Phototroller for indoor applications where low sensitivity is permissible.

Cut Courtesy Westinghouse

quency of the light. Thus it is seen that a quantum of ultra-violet light contains more energy than a quantum of visible light.

The smallest particle having the characteristics of its element is the atom. The atom, in turn, is composed of a nucleus, carrying one or more positive charges of electricity, and enough electrons (negative charges of electricity) to balance the charges on the nucleus. All atoms of a given element carry the same number of charges of electricity. The electrons are arranged in various orbits or energy levels around the nucleus.

Now when a light quantum strikes an electron in an atom of photosensitive material, its energy is transferred to the electron. Since the energy which a moving body possesses by virtue of its motion is one-half the product of its mass by the square of its velocity, Einstein has formulated the following relation:

$$\frac{1}{2} mv^2 = hf - p$$

where m = mass of an electron = 9×10^{-28} grams;

v = velocity of emission of electron;

h = Planck's constant = $(6.457 \pm .008) \times 10^{-27}$ erg-sec.;

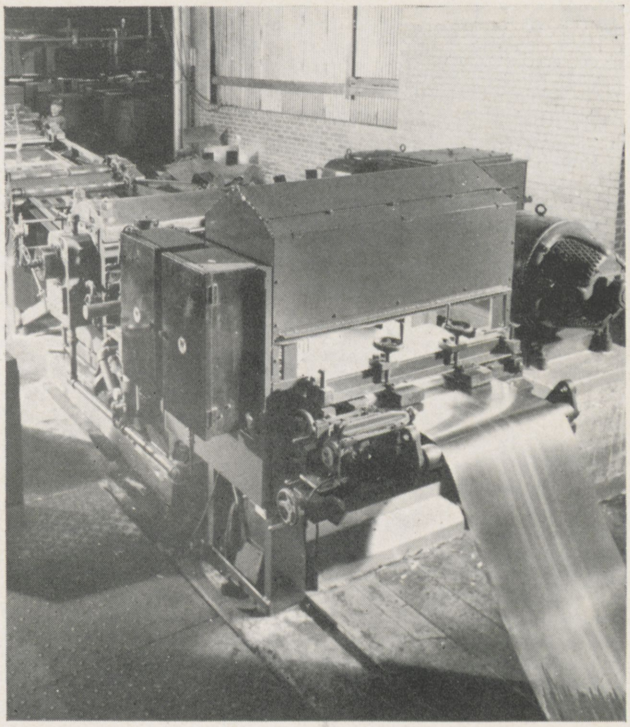
f = frequency of incident light;

p = work required to separate the electron from its atom.

If the frequency of the impinging light is too low, the electron which is struck may merely jump to an energy level farther from the nucleus. Every photosensitive material has a "threshold frequency." This is the frequency of light below which no electrons are forced from the substance. According to Einstein's equation, the product of the threshold frequency by Planck's constant is equal to the work required to remove an electron from an atom of the substance.

Construction and Operation

The modern photoelectric cell consists of a semi-cylindrical cathode coated with a photosensitive material (usually cesium) and a small wire anode, enclosed in a glass tube. The tube may be highly evacuated or may contain an inert gas to a pressure of about 5 cm. of mercury. In operation, the coated cathode is connected to the negative terminal of a source of electromotive force, and the anode to the positive terminal. The electrons emitted from the cathode are carried by the applied potential to the anode, and cause a current to flow in the external circuit.



Typical pinhole detector installation on the shearing line of a strip mill.

Cut Courtesy Westinghouse

The high-vacuum tube has the advantage of rapid response to light fluctuations. Also, the current flowing in it is a linear function of light intensity regardless of impressed voltage; this is a desirable condition in such applications as motion picture sound control.

The purpose of the gas in a gas-filled tube is to increase the sensitivity of the element. When about 20 volts are impressed across the cell, the electrons attain a velocity such that, upon striking the atoms of gas, they knock other electrons off the atoms. These new electrons supplement the current flow; under these conditions the current in a gas-filled tube is greater for a given applied potential than that in a high-vacuum tube. The current, however, is not a linear function of light intensity when the applied potential exceeds 20 volts. For this reason, and because it is slow to respond, the gas-filled cell is used mainly in operating switch relays and similar equipment, for which applications it is ideal. The gas used in cells of this type is nearly always argon, because it is more easily ionized by collision than other inert gases. (An inert gas is essential, because most photosensitive substances are very active chemically.)

Applications

The principal function of the photoelectric cell in the laboratory has been that of measuring and comparing light intensities. Although the velocity of the emitted electrons depends upon the frequency, or color, of the impinging light, the current for light of a given color is controlled by the intensity of the light, and in this respect the photoelectric cell possesses a great advantage over the human eye. Reading a current meter is a great deal easier and gives more accurate results than measuring light intensities by the eye. There is one disadvantage in the use of the cell to replace the human eye in selecting, for example, objects of different color but of equal visual brightness. This results from the fact that the cell reacts to light of such frequencies as that of ultraviolet light. Suppose that radiations from a certain body were to strike a photoelectric cell and the human eye at equal distance from the body. The human eye would register only the effects of the "visible" light,

(*Continued on Page* 22)

High-Pressure Steam Generator

By FRED C. MAIENSCHEIN, soph., ch.e.

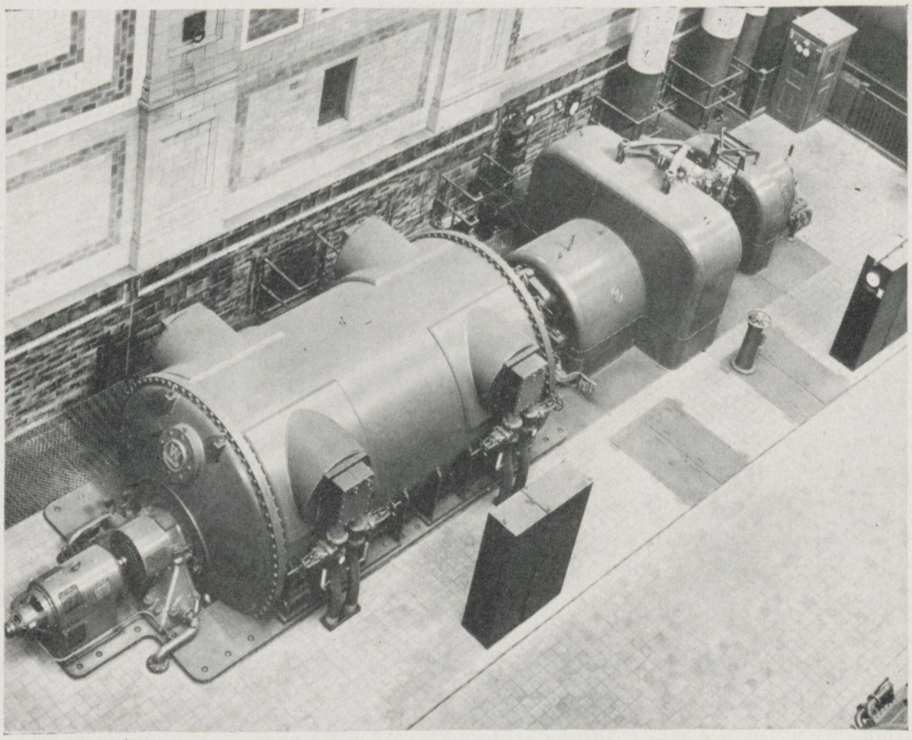
In line with the ever-present striving of engineers to improve upon old and accepted theory are the attempts at utilizing high-pressure steam in boilers, turbines, etc. for economy reasons. Mr. Maienschein here discusses some of these advancements and their applications.

The trend in boiler design is toward higher and higher pressures. These higher steam pressures are usually produced by forced water circulation. This is accomplished by placing a circulation pump in the water cycle and pumping water into the boiler faster than it is evaporated. Forced circulation is required at high pressures since the difference in density of the steam and water, upon which natural circulation depends, becomes insufficient to circulate the water evenly and prevent overheating. The maximum possible pressure with natural circulation is about 1800 psi. Forced circulation brings with it both advantages and disadvantages. One of the most important advantages is the absence of a drum in most forced-circulation boilers. This is a very important economic factor since it is estimated that the main drum for a 1400 psi. boiler represents about half of the cost of the boiler. Lack of a drum means that the boiler has almost no reserve water. This enables steam to be produced quickly but it demands an almost perfect circulation pump. If the water supply were to fail for only a short time much of the boiler would be ruined. However, sufficiently reliable pumps have been manufactured and so this problem has been solved. With forced circulation water flow may be started before the fire is started and excessive temperatures and subsequent strains and leaks are prevented in the water tubes. The smaller size of these tubes made possible by forced circulation greatly aids the solution of the problem of expansion because the smaller tubes can be made thinner and more flexible. A less obvious advantage is that a sample of the boiler water taken anywhere in the system will be representative of all the water. One highly-debatable comparison is that of efficiency. While greater effeciences are not inherent in higher pressures many designers are going to higher pressures to obtain them. Figure 1 shows the operation of one boiler at various pressures and the rise of efficiency with pressure.

The major development in the high-pressure field has taken place in Europe rather than in this country. While the forced-circulation boilers in this country probably number less than a dozen, the proportion in Europe has risen to about twenty-five per cent. In pre-war Germany alone, over 700 such units were in operation. This is, however, a natural and logical development. It may be explained by the difference in power requirements, materials available, and the supplies of labor and fuel. This country has not completely ignored the field. Babcock and Wilcox have been experimenting with boiler pressures up to 5000 psi. Construction Engineering recently installed a 1800 psi. Montaup boiler. Westinghouse holds the American rights to the Benson boiler and has been watching its development closely. Thus while Europe has done the major work we have plans available and could produce high-pressure boilers in quantity if necessary. The following discussion includes some of the more important types of high-pressure boilers.

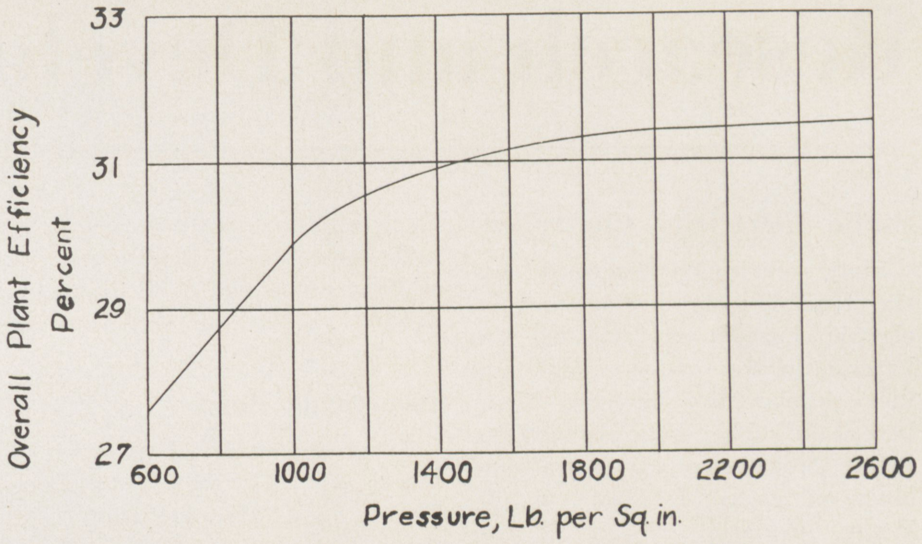
Schmidt-Hartmann

This type of boiler is constructed for pressures from 500-1800 psi. Its characteristic feature is a dual steam circuit. The primary circuit is closed and heated by the furnace in the conventional manner. The steam produced is used to evaporate the water in the separate second circuit.



Turbine designed to utilize high-pressure steam.
Cut Courtesy Westinghouse

Any type of feed water may be used in the secondary circuit and the primary circuit requires almost no make-up water. The unit was originally designed to take advantage of the use of any type of feed water but the advantage that is causing wide-spread use of this boiler today is its production of very pure steam. Thus it is finding use in industrial plants where pure steam is required.



Variations of efficiency with pressure in a certain boiler.

—H. J. Kerr, Trans. A.S.M.E.

Loeffler

Another type designed to overcome feed-water difficulties, this boiler operates at about 2000 psi. It is constructed with only the superheater and economizer in the combustion space. Forced circulation is used. Steam is generated in the drum outside the furnace and then sent to the superheater. About two-thirds of the superheated steam is sent back to the drum and produces the steam there and the other one-third goes to the prime mover. With this arrangement an auxiliary boiler is necessary to get up pressure. The boiler will operate on almost any feed water and control is relatively easy but installation costs are high. One of the outstanding installations of Loeffler boilers is at Brimsdown Station, England, where two 210,000 lb./hr., 2000 psi. units are installed and two 250,000 lb./hr. units are being constructed.

Benson

This boiler was one of the first in the high-pressure field. It was designed by Mark Benson in the early twenties in England. Subsequent development work has been carried out in Germany by the Siemans-Schuckertwerke company. A similar type, the Ramsin unit, has been developed in Russia. The Benson is a completely drumless once-through boiler. It was designed to operate at the critical pressure and thus obviously requires forced flow. In essence the boiler consists of a water tube going through the furnace. It is difficult to determine where one section of the boiler ends and another begins. However, the superheating section of the tubes is located away from the high temperature gases. This is necessary to protect the tubes. Dissolved salts are carried in solution in the boiler water until the water is all evaporated, which occurs in the superheating section, and then are deposited on the tubes. This crust insulates the tubes and cuts down heat conduction which in turn produces excessive temperatures in the tubes and burns them out. Therefore the salts are made to settle out in a lower temperature transition zone. The salts are removed from this area by the circulation of water whenever the boiler is closed down. When the boiler is in continuous operation for over three months it must be shut down for salt removal. This operation takes about thirty minutes. The Benson has almost no reserve water and so must have good pumps and excellent control. The size of the pumps required, however, is relatively small. Because of the small reserve starting time is ten to fifteen minutes. This factor and the ease of running at tremendous overloads makes the Benson valuable for stand-by work. The Benson needs good water but any fuel will do. It may be operated at any pressure. Units have been designed from 400-3300 psi. and many units work on a variable pressure system. At least one Benson boiler has been constructed with a double wall. This enables the furnace proper to be under a slight pressure and still not have outward leakage by maintaining a slightly higher pressure in the space between the walls. It also almost completely eliminates loss due to radiation. One of the outstanding Benson boilers is the one at Langesbuegge (Belgium) which produces 220,000 lb./hr., but due to the small size and safety of the boilers about half of the Bensons produced have been placed in marine service.

Lamont

The main feature of the Lamont is the extreme flexibility of tube design and placement. It is a forced-circulation type with an externally mounted drum, which acts as a separator. The drum is fed water with a conventional feed pump. A circulating pump moves the water from the drum into the tubes. Each tube contains an orifice which controls the water flow. With the correct size orifice the tubes can be placed in any position and sufficient flow maintained through them. By use of this arrangement the ratio of water pumped through to the amount of steam produced can be reduced to less than four. The circulation pump requires from .5 to .7% of the boiler output. The drum, which greatly increases the original cost, presents two advantages. It makes treatment of the steam-water mixture and blowdown easier and enables the control to be much less sensitive. The Lamont is probably the most popular of all forced-circulation

(*Continued on Page* 22)

Research and Development

Edited by KEITH SUTTON, freshman

Static Electricity Controlled

Static electricity—wayward cousin of man's most obedient servant, electric current—is creating fire hazards in the nation's vital synthetic rubber tire industry. Members of the rubber section of the Ohio Safety Congress recently heard some hints on its control from G. W. Penny, manager of the electrophysics department of Westinghouse Research Laboratories.

Most fires on tire fabric production lines are blamed on the igniting of highly volatile rubber cement by static electricity. The electricity is generated in the unrolling of layers of treated cotton or rayon tire cords, which are separated by canvas liners. It clings to the cords as they go into the successive process which involves the use of rubber cement.

Officials of two of the nation's largest tire manufacturing companies have asked the advice of Westinghouse research engineers on combatting this fire hazard.

Impregnation of the canvas cloth rolled between the cord layers was advocated by Mr. Penny as the most practical method now known of reducing the fire threat on tire production lines. Other methods have proved insufficient or have interferred with the efficiency of the manufacturing processes.

"Artificially-created humidity in the factory helps to eliminate the formation of static electricity," Mr. Penny said, "but it affects the quality of the tires. Ways of neutralizing the static electricity have proved impractical. Grounding of the machinery is not wholly effective. Impregnation of the liners which are used over and over again will prove most practical as a fire deterrent."

Static electricity, the engineer explained, is created when friction causes electrons to be rubbed from atoms in one object and adhere to an object of different characteristics. Such electrons are not very active and soon spend themselves, but while present are highly dangerous around volatile or explosive materials.

Insecticide Bomb

From the start of the war to March 1, 1944, the Westinghouse Electric and Manufacturing Company has supplied Uncle Sam's armed forces with more than seven million insecticide bombs—enough to rid a billion Army pup tents of all disease-carrying insects, according to J. H. Ashbaugh, manager of the Company's Electric Appliance Division.

Thousands of these metal dispensers, each about the size of an ordinary household tin can, are being shipped daily to America's fighting men in the Southwest Pacific and other tropical areas. Harmless to humans, the fine mist discharged from the dispensers exterminates mosquitoes, flies, and other disease-spreading insects in tents, barracks, tanks, airplane cabins and even fox holes.

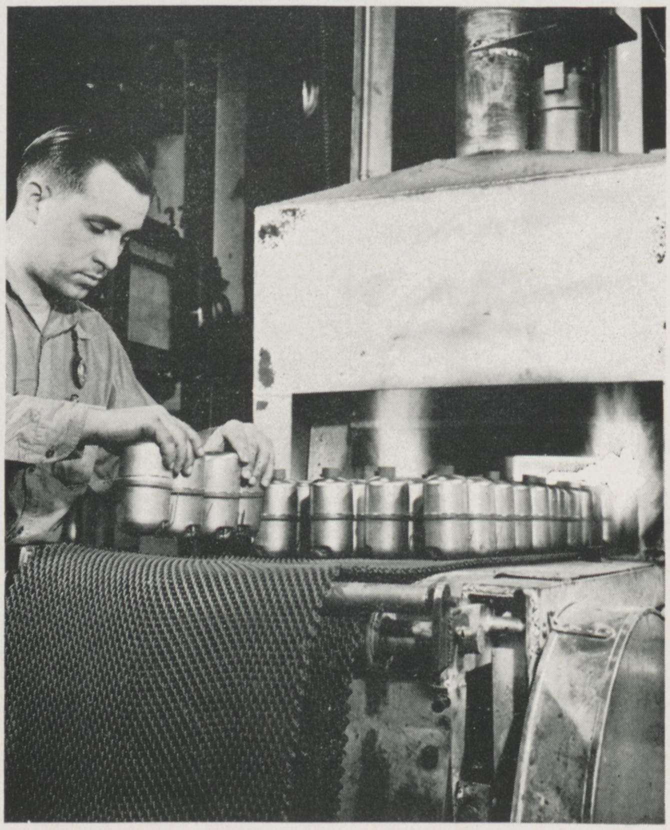
So potent is the insecticide — called aerosol — that seven million of these bombs could kill the insects in every house in North and South America. The 1940 census counted 37,366,890 homes in the United States; seven million insecticide bombs could eradicate pests in 70 million houses.

Post-War Uses

A war-born invention, the device will probably be used after the war to kill insects in farm buildings and homes. It may even be developed to the point where, with thin paint substituted for the insecticide, it can serve as a paint gun to spray furniture, automobiles, and other articles. Moreover the research work required to produce a container that met rigid government specifications led to a new brazing technique that will undoubtedly play an important role in the production of improved post-war appliances such as electric steam irons.

Freon Expels Insecticide

In use today on the fighting fronts, the bombs contain a mixture of



Curtains of fire prevent oxygen from entering this electric, atmosphere-controlled furnace in which paper-thin safety disks are brazed to insecticide containers.

Cut Courtesy Westinghouse

pyrethrum, sesame oil, and Freon, developed by the Department of Agriculture. The correct combination of pyrethrum and sesame oil creates an insecticide deadly to insects; Freon, the gas that creates the "cold" in refrigerators, provides the pressure to expel the insecticide and carry it suspended in mid-air.

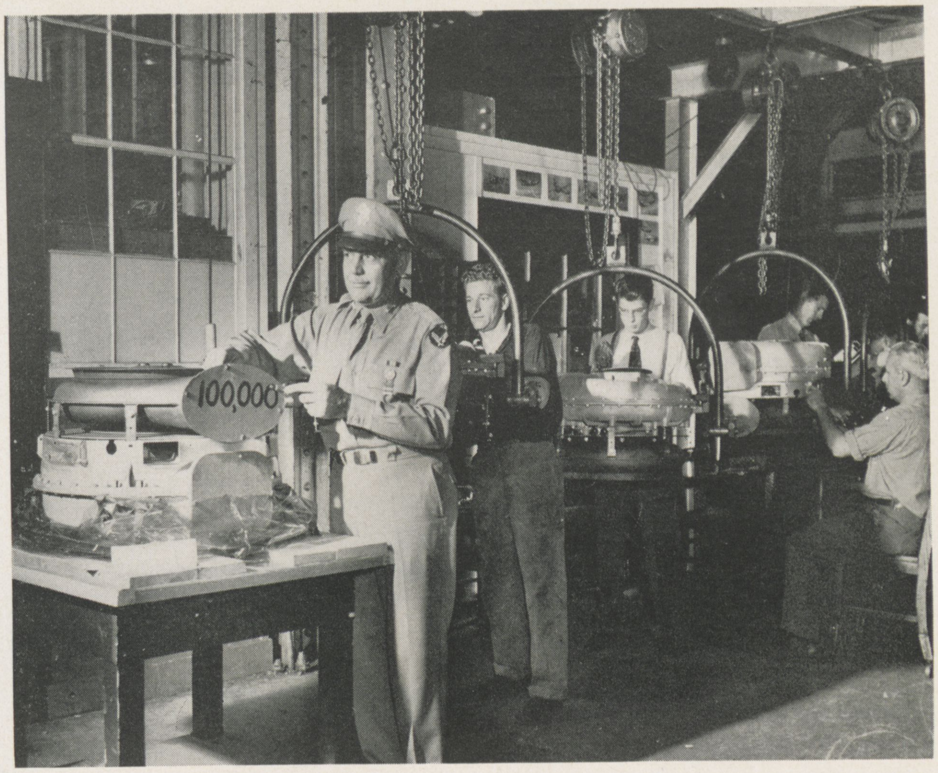
When a soldier wants to rid his tent of mosquitoes, flies, and lice, he unscrews a cap attached to a needle-sized tube extending down into the bomb, and points the outrushing spray in various directions. In about three seconds enough insecticide is emitted to kill all the insects in the pup tent, and the soldier shuts off the spray by replacing the cap.

Each dispenser contains one pound of insecticide, sufficient for 12 to 14 minutes of spraying—enough to "de-bug" 150,000 cubic feet of space, or the equivalent of 240 pup tents or 50 giant bombers. The light-weight steel containers, developed by Westinghouse in collaboration with the office of the Surgeon General of the Army, are thrown away when empty, making it unnecessary to carry cumbersome spraying equipment.

Refrigeration Techniques Used

At Westinghouse plants in Mansfield, Ohio, and East Springfield, Mass., which formerly produced household refrigerators, overhead conveyor chains and even paint-baking ovens have been converted to the production of the dispensers. In fact, refrigerators have figured prominently in the design and manufacture of insecticide bombs. Besides using some refrigerator production equipment to turn out the dispensers, Westinghouse patterned the can after the float valve used in refrigerators. In addition, the refrigerant Freon provides the pressure to spray the insecticide.

The same engineers who in peacetime design refrigerators worked for months on the design of a container to hold the insect-killing insecticide necessary to protect the lives of our fighting men. The can had to be lightweight for easy handling, yet strong enough to withstand up to



General Electric turns out 100,000th turbosupercharger.
Photo Courtesy General Electric

2,000 pounds of pressure per square inch.

Metals Brazed In Electric Furnace

The result was a container 44 thousandths of an inch thick to which a rupture disk—a sort of safety valve—was brazed. The design of this rupture disk and the development of a way to attach it firmly to the can was the toughest job of all so far as the container was concerned.

In the first place, the container had to be equipped with some kind of a safety valve which would give way if the pressure inside the can built up to between 350 and 700 pounds per square inch. Without such a valve, the bomb could explode and cause injury and damage under certain conditions such as 180-degree heat in a ship's hold.

Westinghouse designed a rupture disk shaped like a clover-leaf. It is only three thousandths of an inch thick—about the thickness of a human hair—thin enough to give way and let gas escape slowly before the can could explode. But design of the disk was much less difficult than perfecting a way to braze it to the can. Only by extensive experiments with an electric, atmosphere-controled furnace was the "wedding" of the two metals—one about 15 times thicker than the other—made possible. By precise control of nitrogen, hydrogen, and carbon dioxide at temperatures in excess of 2,000 degrees Fahrenheit, engineers arrived at the right atmosphere mixture to securely braze these two metals together.

What the welder sees through the window of his hood is limited. The brilliant arc provides the only light for the welder to see by, and when it goes out the welder is blind and must raise his hood to position the welding rod. The difficulty of seeing what is being done through the glare of the arc is obvious. The welder can easily see through the glass of his hood to position the welding rod as the lamp supplies ample light.

Another lighting application speeds the spot welding of aluminum and steel sheets for fighting planes and other war equipment. When sheets of aluminum are placed between the electrodes of a resistance welding machine, the operator is unable to tell the exact point at which the copper rods will clamp together to make a spot weld. Mr. White devised a pin-hole lamp which throws a tiny dot of light on the tip of the copper electrode. This shows the operator the exact spot at which the weld will be made before the rods come together to sew a "stitch" with electricity, and thus enables him to space his welds evenly, making a stronger, more uniform seam.

No Scurvy Among Our Troops

To prevent scurvy in the armed forces "where men are isolated from fresh food supplies" synthetic vitamin C is very useful, Dr. Charles G. King of Scarsdale, N. Y., scien tific director of the Nutrition Foundation, Inc., New York, declared in a General Electric Science Forum address at Schenectady, New York, August 5. "A pound of the pure crystals, if taken in small, regular dosages, would last a person half a lifetime," said Dr. King, who also is visiting professor of chemistry at Columbia University.

"The armed forces now use large quantities of the pure vitamin to blend with dried lemon flavor and sugar," he explained. "Every soldier in the field can add a small bit of the powder from his lunch packet to a cup of water, and thus have a drink of lemonade, with confidence that the vitamin C is there."

"Since the dawn of history, man has discovered over and over again that there is something in fresh foods that is necessary for the preservation of health and physical strength," he added, pointing out that Napoleon's disastrous campaign in Russia collapsed in part because his troops were weakened by the onset of scurvy. Dr. King also mentioned it has been estimated "that up to the time of World War I, more men had been lost at sea from scurvy than from all the losses in naval warfare."

"When Rear Admiral Byrd made his last trip to the Antartic, a small package of pure, crystalline vitamin C gave his crew full assurance against scurvy," he said. This form of the vitamin is now isolated from lemon juice and from corn sugar in abundance.

G.E.'s 100,000 Turbosuperchargers Recover 66 Times Power Generated By Boulder Dam

With the shipment of the 100,000th turbosupercharger produced in General Electric plants, the company has given Uncle Sam's fighting planes the means of recovering at high altitude more than 66 times the power generated at Boulder Dam, or almost twice the output of the entire nation's steam power plants combined, according to G-E engineers.

Aircraft engines, like crews, require oxygen at high altitudes, and a turbosupercharger recovers for a 1200-horse-power engine the 920 horsepower it would otherwise lose at 34,000 feet altitude. Thus 100,000 turbosuperchargers recover 92 million horsepower in enabling American planes to function at maximum strength at high altitudes.

It was during World War I that G. E. designed and built the first supercharger, but peace-time requirements were so low that production dwindled to a mere 15 in 1938. After Pearl Harbor, however, aircraft schedules skyrocketed. Boeing's Flying Fortress required a turbosupercharger for each of its four engines, and the B-29 two for each engine. Other turbosupercharged planes are the Consolidated B-24, C-87, and PB4Y-1, Lockheed P-38 and Republic P-47 and P-47M.

So the tiny G-E supercharger factory at Lynn, Massachusetts gave way to a giant plant there and also large plants at Everett, Massachusetts and Fort Wayne, Indiana. But no single manufacturer could handle overnight the staggering production, so Allis-Chalmers and the Ford Motor Company began manufacturing to G-E design. In 1943 alone, millions of square feet were devoted to turbosupercharger production employing thousands of persons. Today the total output of G-E plants alone equals that of Allis and Ford combined, racking up since Pearl Harbor such engineering and production records as the following:

Power Recovery. Without a supercharger, a 1000-horsepower aircraft engine as built in 1941 would develop only 370 horsepower at 25,000 feet. But in 1944 engines rated at 1200 horsepower and to be flown at 34,000 feet would deliver only 280 horsepower by themselves, so turbos to recover the lost 920 horsepower were developed for mass production. This was a new high in recovery.

Weight. Although called upon to recover more horsepower, Pearl Harbor turbos and those of today weigh substantially the same—135 pounds. Thus aircraft designers are spared their chronic headache—extra poundage.

Power-recovery ratio. The basic test for rating efficiency of energy is the amount of horsepower delivered per pound weight of the generating device. For the 1941 turbo, the weight per turbo-recovered horsepower was .214 pound; for today's model, .146, or a weight decrease (and therefore an efficiency increase) of one-third.

Cost. The Pearl Harbor model supercharger cost the government three times as much as today's improved unit. In terms of cost per recovered horsepower, today's turbo costs less than one-fifth as much as the 1941 model. The intensive effort of engineers and manufacturing experts in organizing large-scale production is saving Uncle Sam some seven million dollars weekly at the present production rate.

Servicing. In 1941 a turbosupercharger required a major overhaul at the end of 300 hours; today's model requires only a minor overhaul after 1300 hours, or more than four times the operating period. This improved endurance compares with engine overhaul requirements of 300 hours three years ago and 500 hours today.

These records were made possible by a variety of engineering and production contributions of the Army

(*Continued on Page* 20)

My Latest Mishap

By E. JAMES HEGARTY, sr., c.e.

Being the not proud possessor of a fragile frame I am continually breaking, straining, or spraining some member of my before—ad physique. Everyone likes to tell of their operations and experiences while at the hospital. Being like everyone (my mother keeps telling me to bolster my morale) I too would like to tell of my latest mishap. I will only tell of my experiences at the hospital because I partook in no operations (the nurses didn't appeal to me—read that as its printed please).

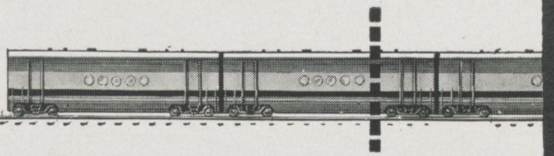
One quaint Thursday early in June the senior class less than a month from graduation decided to impress (several weighty members in the senior class) the underclassmen by thoroughly tamping them in typical Rose brawl. At noon the seniors garbed in their fighting clothes and reinforced by breakfasts of Wheaties started the fireworks. The seniors worked as depanzer division. The unsuspecting underclassmen were caught—and their pants were down. I was classified as an underclassman at the time but I also qualified as a senior on service stripes. I chose to fight with the seniors because they were slightly outnumbered and seemed like the logical winners which had a slight influence on my choice. I had helped depants a few underclassmen when at least 22 underclassmen, well 17, okay 8, so it was four, well anyway both of them having an aggregate weight of one-ninth kip pounced on I. They roughly knocked me down and something snapped in my shoulder. I groaned and went through the various facial contortions to show I was in agony. I could have easily won an Oscar for my performance. What a performance! The underclassmen let me loose realizing I was suffering—more than usual. When I arose I gaped in amazement at my left shoulder. Something was radically wrong. Why in this condition the padding in the shoulder of my new suit would serve as shoulder padding rather than doing service as elbow padding as it does under normal conditions. I queried a few of the brawl participants as to the nature of my injury but they were too interested in the melee to be bothered with diagnosing my condition in true Boy Scout style. Enduring the supposed great pain I left the site of the brawl and walked through the school halls in search of sympathy and advice. I was advised to go in town to see a doctor and that I did. A fellow student drove me to the nearest hospital. The only sympathy I got was when I turned on the radio in the car and heard a few cords of Anduro Toskanloni's string section playing "Swinging On A Star!" Accompanied by my chauffeur I entered the hospital dressed in what the best dressed man wouldn't dare wear. I was shirtless, seat-of-the-pantsless and what remained of my attire couldn't have fed an understuffed moth.

I was greatly awed by the fact that I didn't make a more impressive entrance into the hospital. No ambulance; no sirens; just sadly depleted I walking in the main entrance. If it wasn't for the unusually large bump on my left shoulder one would suspect I had come for my daily hypho or possibly a half a vitamin pill. I was directed to the emergency room on the 4th floor by a quince-faced motherly looking sort of a janitress who appeared as if she had worked her way up from patient and was going to be demoted real soon. I rode up to the 4th floor in an elevator operated by a pre-med student whose eyes gleamed with joy as they surveyed my injury indicating that I was in sad shape. I told him my story of woe and he said "Yup, (there was a cuspidor in the elevator) it certainly is a sad situation." I got off at the 4th floor and entered the emergency room. This room consisted of floors, walls, ceiling, two windows high enough to jump out of in the center of which crouched a beddish sort of a structure. If anyone had tried to tell me that George Washington slept here I would have called them a prefabricator. Situating myself as comfortable as possible in this room I was swiftly attended to by a covey of nurses. Showing my mental prowess I answered all the routine questions these prospective Florence Nightingales asked me in true quiz kid fashion. Next I was taken to the X-ray room so what my injury was could be determined. I posed before the machine and snap it was all over. I awaited the results of the X-ray with anxiety chewing my fingernails to the elbow. The results were announced to me thusly. "You are very photogenic. You need your four teeth filled. You also have a dislocated shoulder." I swooned a clunk on the floor in true Sinatra admirer style when I discovered I was injured so thoroughly. When I became unswooned I found myself back on the bed in the emergency room with a doctor not resembling Lionel Barrymore hovering over me wondering whether I was a fatality or not. The doc asked, "Dislocate your shoulder huh." To prove I wasn't dead I replied, "Nope, I knew it was there all the time." Then re-enacting the balcony scene of a local theatre the doc took hold of my left hand with a foot on my abdomen to hold me down and giving my wrist a twist a noise the reverse of the noise of my shoulder popping out occurred. My shoulder was back in place. The doc then taped my left arm to me in such a manner that it made picking my nose a task. The doctor then gave me explicit instructions on what to do and what not to do in my sad state and I did them for six weeks.

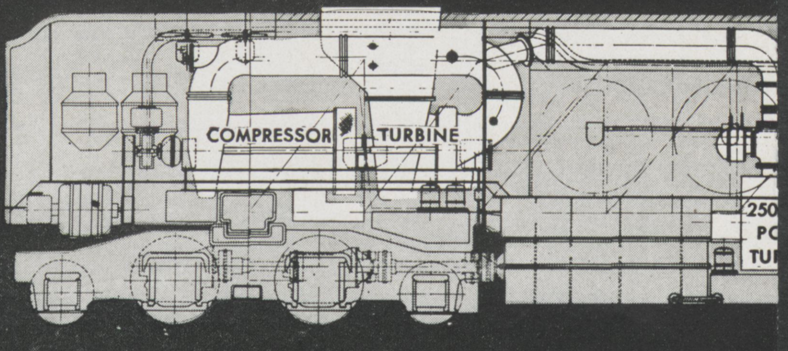
(*Continued on Page* 23)

How to Cut a Locom

YET MAINTAIN ITS



PLAN TO USE ALLIS-CHALMERS GAS TURBINES!



Actual Blueprint of a 5000 horsepower A-C Gas Turb

Today, A-C built Gas Turbines help boost output of U. S. super aviation fuel—promise to revolutionize power production in many fields after the war!

"ENGINEERING THAT AIDS ALL INDUSTRY FURTHERS AMERICAN GOOD LIVING"

A-C

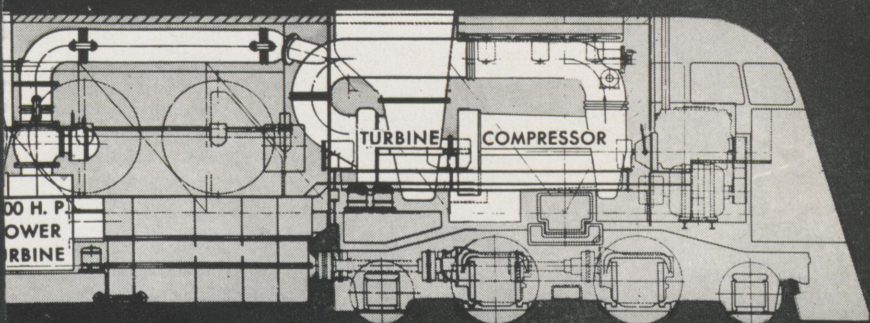
OVER 1600 PRODUCTS

Supplying the World's Industrial

ALLIS-CH

...tive in Half—

TOTAL HORSEPOWER!



...ven locomotive. Half conventional size—same power!

"TORNADO IN A BOX!"..."Simplest, most compact engine ever invented!" ... Biggest power story in 50 years!" ...

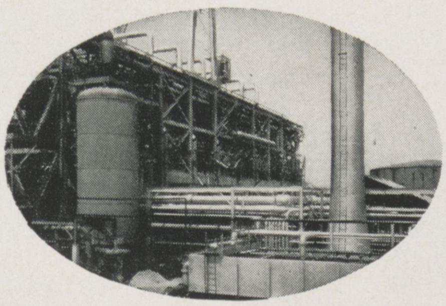
That's how engineers describe the sen-tional, new gas turbine . . . now in pro-uction at Allis-Chalmers!

It's already helping to win the war!

Today, A-C built gas turbines help save recious power, in U. S. oil refineries. esult: 100-octane gasoline flows faster to . S. fighting planes!

In the future, designers see: Power ants for locomotives that take up half he space yet deliver the same power as onventional engines! Gas turbine-pro-elled ships that carry 1000 tons more argo without increasing length or dis-acement! Cheaper postwar production things American buyers need and want!

Today, Allis-Chalmers has more gas-turbine units in use than all other companies combined—and with 1600 different products in the battle of production, is building the greatest wealth of experience in the capital goods field.



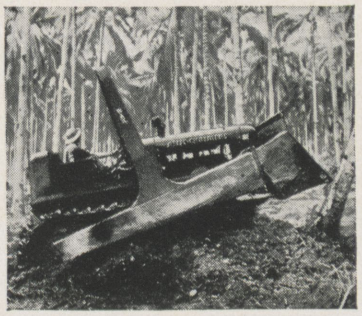
A-C Gas Turbines have already been installed in modern oil refineries like this.

VICTORY NEWS

24-Hour-A-Day Welder: A new A-C welder—the Ampac "400" with sufficient capacity to use ¼" rods 24 hours a day—has recently been announced by Allis-Chalmers.

The Ampac "400" is simple in design—rugged in construction and covers a welding range of 50 to 500 amps in 8 easy turns of control wheel. Cuts welding time—speeds output! For further information, write for bulletin B6302, Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisconsin.

Front Line Action With The Seabees: In the South Pacific, big Allis-Chalmers crawler-type tractors have seen plenty of service clearing invasion roads—hacking airstrips out of jungles—filling shell craters.



At times, these 14-ton Diesel-powered giants have operated in temperatures as high as 175° in the sun . . . and in Alaska, at 65° below zero!

What Are Your Marine Needs? Allis-Chalmers has immediate capacity available for all sizes of Surface Condensers—built to either Navy or A.B.S. requirements—with or without Steam Jet Pumps.

Also capacity in varied amounts for hollow-bored and solid shafting, special forgings, large iron castings, engine frames, beds, etc. Check with us today.

ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

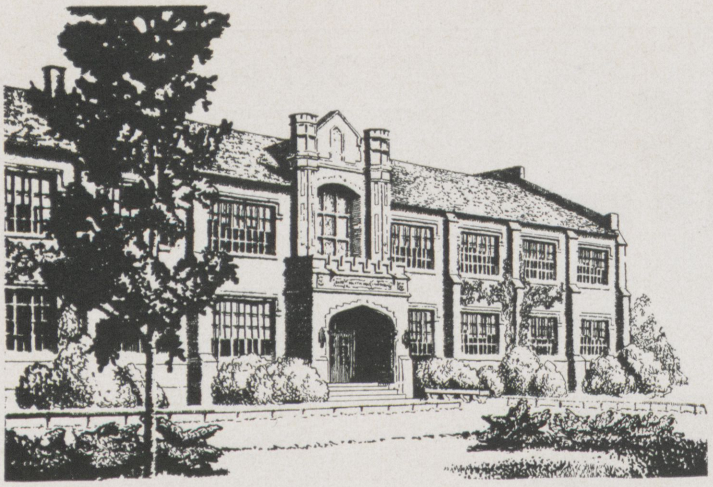
FOR VICTORY
Buy United States War Bonds

...argest Line of Major ...Equipment—

...ALMERS

BACK ON THE AIR, OCT. 7
THE BOSTON SYMPHONY
8:30 P.M. E.W.T.—SATURDAYS

BLUE NETWORK — COAST-TO-COAST



Campus Survey

By C. GORDON HAYES, freshman

Glee Club

The Rose Tech Glee Club had its organization meeting late in July. At this meeting officers were elected and plans were made for holding regular meetings and rehearsals. The members decided to ask Mr. Taflinger to continue his splendid work as director of the club and to ask Mrs. Bennett to continue as the pianist for the club. The officers elected for the following term are:

President .... John Murdock
Business Manager ...... Robert Gillum

Rifle Club

The Rose Poly Rifle Club held its first meeting of the new semester on August 21. The purpose of this meeting was to elect officers and get the club organized. The sponsor for the club has not yet been determined as the former sponsor, Captain Colwell, has been transferred. The officers elected were:

President .... Pete Lee
Sec.-Treas .... William Waldbeiser

Camera Club

The Rose Camera Club held its first meeting of the new term July 24. Robert Gillum has charge of the club as officers have not yet been elected. The Camera Club is one of the most active clubs on the campus. The members have been quite busy making prints and enlargements of various pictures they have taken on the campus and elsewhere.

Debate Club

The Rose Tech Debate Club which was organized early this semester has been having weekly meetings and discussions. Current topics have been the basis for these talks. Those boys who are taking part in these talks are Ted Blickwedel, Charles Kessler, Ned Koonman, and Charles Stringfellow. The way things look now the Debate Club is in for a big season. They are entering the season under the guidance of the following officers:

President .... Joe Durra
Sec.-Treas. .... Fred Maienschein

Freshman Class

The freshman class got off to a good start by organizing the class and electing officers. Those chosen to lead the class were:

President .... Pruett Hart
Vice-Pres. .... Arnold Hannum
Sec.-Treas. .... Haverkamp

So far this term the freshmen have done all the work that the sophomores consider necessary to keep them out of trouble and to keep their time occupied. The first job the freshmen did was to fix the raft so that the student body could use it without fear of drowning. Next in true Rose fashion the freshmen gave Rosie her new coat of paint and numbers. Friday, July 28, is an unforgetable day in the minds of all the freshmen, for on that day they were taught to pay tribute to Rosie in the proper way. Rosie, fresh in her new coat of paint, was wheeled

(Continued on Page 23)

The Freshmen pay tribute to "Rosie." *Photo by Wehle*

Alumni News

Edited By HOWARD FREERS, soph., m.e.

The Grads Advance

'11 Wilbur B. Shook, A.E., and his partner William C. McGuire have been appointed to draw up detailed plans for postwar expansion of Evansville College.

'22 Joseph A. Engelhard, M.E., is acting president of the Glenmore Distilleries Co., Louisville, Ky.

Henry Y. Offutt, E.E., is president of the Kentucky Title and Trust Co. Louisville, Ky.

'30 Dudley F. Williams, E.E., who is with the Ohio Oil Co., has been transferred to Tampa, Florida.

'42 David M. Demaree, M.E., has taken a position with Goodyear Aircraft Corporation at Phoenix, Arizona.

Marriages

Captain Joseph E. Ross, '39, ch.e., with honors, to Miss Carolyn A. Geever of Bel Air, Md.

2nd Lieut. Edgar R. Carpenter, x-'44, to Miss Judy Popper of Indianapolis.

2nd Lieut. William H. Plenge, x-'44, to Miss Mary Ellen Fox of Terre Haute. The marriage took place July 12, at Fort Belvoir, Va., after Lieut. Plenge's graduation from engineers school.

New Arrivals

Richard K. Toner, '34, ch.e., with high honors, and Mrs. Richard K. Toner announce the arrival of a daughter, Virginia Kay, on July 31.

Lieutenant Robert G. Sears, '37, ch.e., and Mrs. Robert G. Sears announce the arrival of a daughter, Marjorie Carol, on July 10.

Darrell E. Criss, Feb. '43, e.e., with honors, and Mrs. Darrell E. Criss announce the arrival of a daughter, Pamela, born July 20.

PAUL D. JEWELL

Announcement has recently been received of the commissioning of Paul D. Jewell, as a flight officer in the army air corps. Previous to his enlistment in the air corps Paul was a member of the class which graduated in July, 1944.

Deaths

Robert J. Owen, '20, m.e., died July 20 at Indianapolis. He was Vice Pres. and Gen. Mgr. of the Thomas and Skinner Steel Products Co.

Ernest W. Klatte, '09, c.e., died August 17 in an Indianapolis hospital. He was connected with the Cinder Block and Material Co. until 1942, when he retired to a farm near Clayton, Ind.

Henry W. Heidinger, '08, m.e., died August 19 in Terre Haute.

John Daly of Oceanside, N. Y., who attended Rose from Oct. '42 to March, '43, when he was inducted, was killed in action in Normandy, August, 1944.

In The Service

'40 Robert P. McKee, m.e., has been promoted to Lieutenant (j.g.) and is stationed at Pensacola, Florida.

'42 Arthur D. Owens, m.e., has been promoted to captain and placed in charge of the Army Air Forces Maintenance Division at Rome, New York.

Eldon M. Sutphin, ch.e., has been promoted to major.

'44 (July) George R. Butwin, c.e., Robert H. Dinkel, e.e., Charles R. Fox, c.e., and Frank W. Guthrie, m.e., have been commissioned ensigns in the United States Navy.

x-'44 (July) William H. Plenge, Loren Pittman, and William G. Cornell have been commissioned 2nd lieutenants upon graduation from Officer Candidate School at Fort Belvoir, Virginia, on July 12.

Charles W. Newlin, C. Graham Weibel, Edgar R. Carpenter, and C. Phillip Bowne have also recently been commissioned as 2nd lieutenants in the engineers corps.

x-'44 (Dec.) Robert W. Flack and Robert Brandenburg are now in the navy radar school at Texas A. & M.

Carl Wodicka, Marshall W. Roesch, Rex Blood, and Bill White are now in the navy, stationed at Great Lakes, Ill.

Warren R. Pugh has been transferred to California Polytechnic Institute at San Luis Obispo. He is in the navy air corps.

Rich Dill is now in the army and is at present stationed at Camp Blanding, Florida.

Recent Visitors

July

'19 Clarence E. Pigg, ch.e.

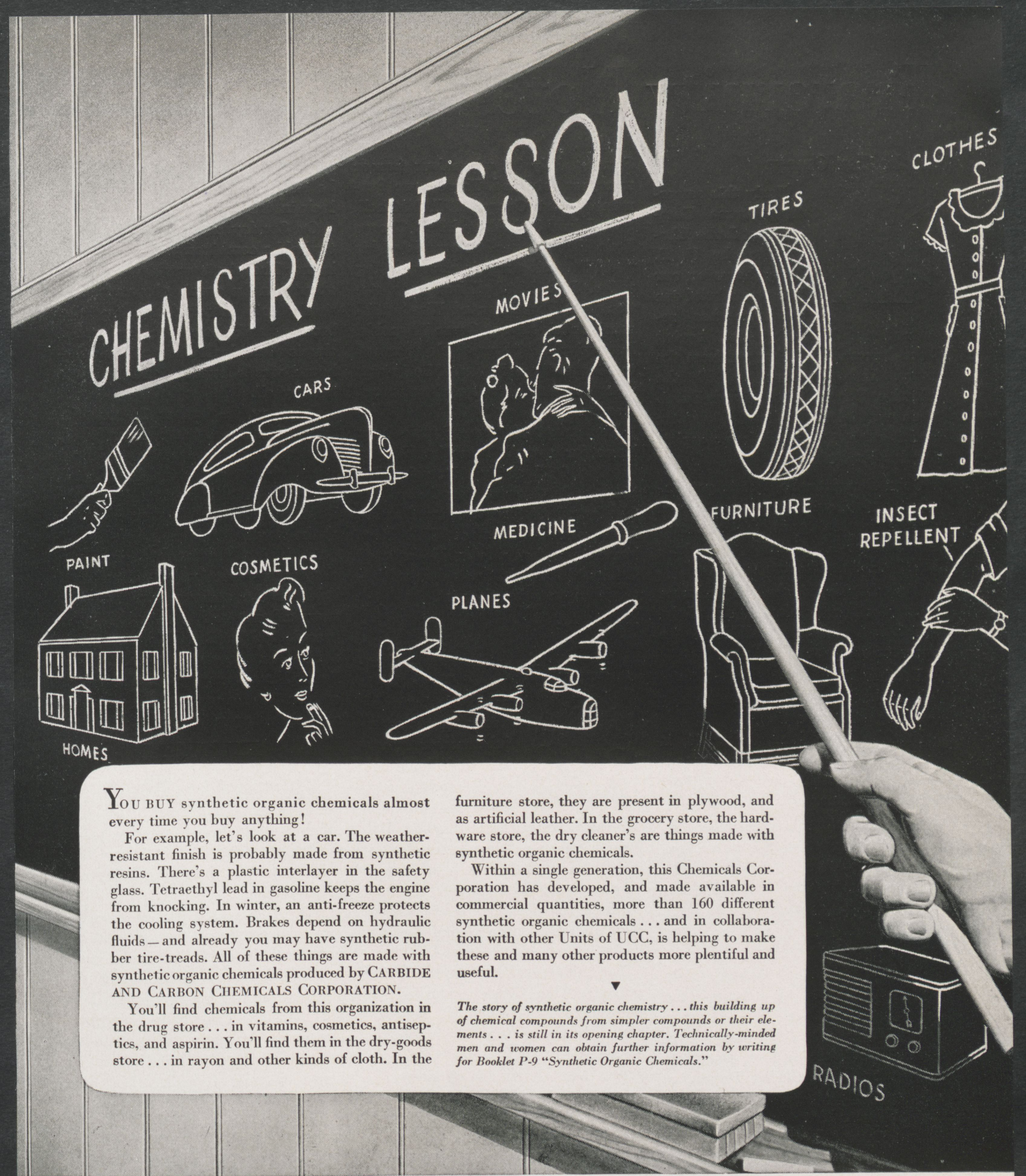
'32 Robert A. Wilson, c.e., with honors.

'38 Richard E. Dennis, m.e.

'40 Willis R. Lucas, c.e.

'42 James Osman, e.e.

(*Continued on Page* 23)



YOU BUY synthetic organic chemicals almost every time you buy anything!

For example, let's look at a car. The weather-resistant finish is probably made from synthetic resins. There's a plastic interlayer in the safety glass. Tetraethyl lead in gasoline keeps the engine from knocking. In winter, an anti-freeze protects the cooling system. Brakes depend on hydraulic fluids—and already you may have synthetic rubber tire-treads. All of these things are made with synthetic organic chemicals produced by CARBIDE AND CARBON CHEMICALS CORPORATION.

You'll find chemicals from this organization in the drug store . . . in vitamins, cosmetics, antiseptics, and aspirin. You'll find them in the dry-goods store . . . in rayon and other kinds of cloth. In the furniture store, they are present in plywood, and as artificial leather. In the grocery store, the hardware store, the dry cleaner's are things made with synthetic organic chemicals.

Within a single generation, this Chemicals Corporation has developed, and made available in commercial quantities, more than 160 different synthetic organic chemicals . . . and in collaboration with other Units of UCC, is helping to make these and many other products more plentiful and useful.

▼

The story of synthetic organic chemistry . . . this building up of chemical compounds from simpler compounds or their elements . . . is still in its opening chapter. Technically-minded men and women can obtain further information by writing for Booklet P-9 "Synthetic Organic Chemicals."

BUY UNITED STATES WAR BONDS AND STAMPS

UNION CARBIDE AND CARBON CORPORATION

30 East 42nd Street UCC New York 17, N. Y.

Principal Units in the United States and their Products

ALLOYS AND METALS
Electro Metallurgical Company
Haynes Stellite Company
United States Vanadium Corporation

CHEMICALS
Carbide and Carbon Chemicals Corporation

ELECTRODES, CARBONS AND BATTERIES
National Carbon Company, Inc.

INDUSTRIAL GASES AND CARBIDE
The Linde Air Products Company
The Oxweld Railroad Service Company
The Prest-O-Lite Company, Inc.

PLASTICS
Bakelite Corporation
Plastics Division of Carbide and Carbon Chemicals Corporation

Fraternity Notes

Alpha Tau Omega

Early this semester Gamma Gamma, lost Lubo Chelich to the U. S. Navy, however, our loss was a brief one as Lubo has returned to the active list, having been honorably discharged from the navy. Lubo returns to fill the Worthy Ushers office. Fred Lundgren was also lost to the chapter and is now at Great Lakes completing his boot training.

John Stewart who, due to government action, withdrew from school at the beginning of the semester left for service Saturday, September 9, . . . destination unknown.

The chapter is glad to welcome back Brother Colclesser, c.e., July, '44. Bill is awaiting call from the army or navy or something.

Brother Jay Kress also of July, '44 is back in town, presumably awaiting similar action.

Brother Milholland, July, '44, is in Fort Worth, Texas. Mailing address 2320 Hillcrest Ave., Fort Worth 7, Texas.

Brother Freers has bestowed his pin on a member of the fairer sex. Miss Eleanor Reeder of Indianapolis is now wearing the Maltese Cross of A. T. O. Congratulations to both.

Lambda Chi Alpha

Theta Kappa Zeta wishes to announce the marriage of Harmon Shaw and Mary Ann Soules. The wedding took place last July 27 in the Methodist Temple at 7th and Poplar Streets. Robert Kylander was best man, and Seaman Robert Greger, home on leave, arrived just in time to serve as one of the ushers. Harmon, a former Rose student, is well remembered by many of the men at the Institute. Congratulations, Harmon!

The chapter had a reunion on Sunday, July 30, when four former members returned. These were Seaman Robert Greger, Bill Mitchell, Pvt. John Mitchell, and Pvt. George Kyle. Bob Greger has completed his "boot" training and is now studying radar. John Mitchell had been stationed at Fort Leonard Wood, Missouri, and is now at Camp Reynolds, Pennsylvania. George Kyle returned to Camp Van Doren, Mississippi, where he has been for about seven months.

Lieutenant Phillip Bowne was home for a week recently. He had been in OCS at Fort Belvoir, Virginia, and is now stationed at Camp Shelby, Mississippi, with the Combat Engineers. We expect Will Rose home in a few weeks. He entered OCS with Phil, but was delayed because of an injured wrist.

Theta Xi

The Kappa chapter of Theta Xi is again closing their books on a successful summer semester and have already made several plans for the next semester. Now that Brother Bob Penno has his "Jeep" running, it might be a little hard to foresee what exactly will happen. At least we hope that Pennos' "Jeep" doesn't develop any more leaks in her radiator.

The scholarship key for the spring semester has been awarded to Brother Bob Weinhardt, now on active duty with the Navy. This key is awarded each semester to the active who shows the greatest improvement in grades. The chapter wishes to congratulate Brother Weinhardt and hope that he will be back in there fighting even after the war is over.

Word has recently been received from Texas that Brother Bob Brandenburg, S 2/c in the Navy, was to be married there on Saturday, September 23. We know that Bob will be happy, and we wish him all the luck in the world.

On Sunday, August 27, the chapter held a combined picnic and open-house. The picnic was delayed until about 6 in the evening by a very untimely rain. During this time the brothers and their dates enjoyed a classic at the local cinema. The open-house was a success and fun was had by all.

Saturday, September 16, was the date of the chapters latest stag. Most of the upperclassmen in school were present and they, I am sure, will vouch for its success. Professor Eckerman represented the faculty at the stag.

At the last regular meeting of the chapter, an election of officers was held for the coming semester. The new officers are Stephen Liddle, president; John P. Wehle, vice president; Don Kersten, treasurer; Bob Penno, house manager; Bill Dedert, assistant house manager; Joe Durra, corresponding secretary.

RESEARCH

(*Continued from Page* 12)

Air Forces, G.E., Ford, Allis and other manufacturers and by teamwork in co-ordinating design and manufacturing programs. Improvements include:

New Alloys. One part of a turbo-supercharger must stand red-hot heat from the engine's exhaust gases while another is withstanding the sub-zero of the slip-stream at high altitudes. The 1944 turbo must operate at increasingly cold altitudes, yet spin at greater, and therefore heat-increasing, speeds. Metallurgists supplied the necessary new materials, notably a new alloy especially suitable for welding.

New ball bearings and lubrication. Ball bearing manufacturers developed bearings capable of withstanding the higher speeds, and an oil jet for lubricating them more effi-

(*Continued on Page* 26)

O W I Photo by Palmer, in an Allegheny Ludlum Plant

Final Examination

BEFORE STAINLESS GETS ITS WINGS

REDUCE ACCIDENTS!

In 1941, accidents were first cause of death among men from 22 to 38 years of age. The productive man-days lost were enough to build twice as many battleships as now possessed by the combined Allied Navies.

These are losses that *can* be avoided. Don't take unnecessary risks at any time; and later, when you enter business life, remember that carelessness is the single greatest factor in human and economic loss.

A GREAT deal of costly processing is done on stainless steel, to secure the physical characteristics and surface finish required for the particular war job it is to perform. But one day all the rolling, heat treating and surface finishing is completed, and bright sheets of Allegheny Metal lie ready for final inspection and shipment to the war plants.

They're *right,* those sheets—flawless of surface and true to specifications. They'll do their job and more—which is what everything and everybody *must* do, in a war like this. In the case of stainless steel, that job is the supplying of vastly increased strength with equal or decreased weight, and high resistance to heat and corrosion. These are qualities of great value now, and of even greater promise for the future.

AL
STEEL FOR THE NATION'S WELFARE

Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

W&D A-9319

PHOTOELECTRIC CELL

(*Continued from Page* 7)

while the phototube would respond to all light except that at the extreme red end of the spectrum. For this reason, when it is to replace the human eye in color selection, the phototube must be equipped with filters which exclude all except the visible light. W. F. Hess, in the Rensselaer Polytechnic Institute Bulletin, July, 1929, states "that the cesium cell is the only one which offers possibilities for replacement of the human eye in color photometry, and this only by the use of filters." This is because the maximum point on the curve of response as a function of light frequency for the cesium cell is fairly close to the corresponding point on the curve for the human eye; by the use of filters the two curves can almost be made to coincide. The phototube has become indispensable in laboratories where various types of electric lamps are tested for brightness. It has been found to give results accurate to 5 per cent in this operation.

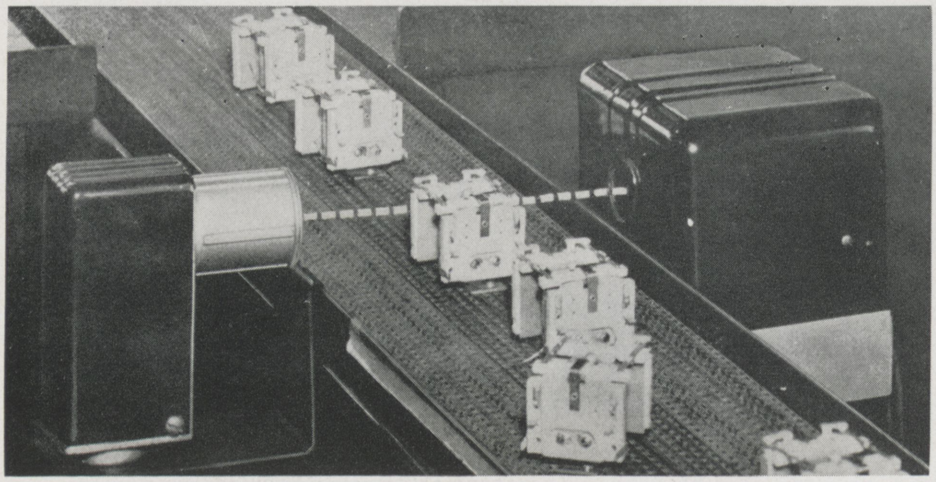
The use of the photoelectric cell in stellar photometry seems to have limitless possibilities. It has made feasible the measurement of the amount of light emitted by extremely distant stars.

Probably no industry makes use of the photoelectric cell on a larger scale than does the motion picture industry. The process by which the effects of sound are recorded on a motion picture film and reconverted to sound in synchrony with the picture projection can be explained in a fairly simple manner. As the film is exposed, the "sound track" on the edge of the film is subjected to the varying beam from a light influenced by the sound connected with the action. Thus a strip of film of varying transparency is produced. As the motion picture is projected, light from a small lamp shines through the sound track upon a phototube. The varying current in the phototube is again transformed into sound by electrical means.

Several suggested methods for television transmission involve the photoelectric effect. One of the most successful of the early schemes utilized a rotating disc containing perforations arranged in a spiral. As the disc rotates, a beam of light from some powerful source, passing through each perforation in turn, scans the subject to be televised. Light reflected from the subject activates phototubes which send pulsating currents to the receiving set. This set contains a rotating disc synchronized with that of the transmitter. A beam of light sent through the perforations varies in such a way as to cause the light at any point on the receiving screen to be equal in intensity to the light at the corresponding point on the subject.

The feeble current from a phototube may be magnified by electronic or electromagnetic relays and used to operate electrical controls of various kinds. The relay makes possible the well-known "electric eye" burglar alarms, door-opening devices, and a multitude of other ingenious contrivances.

It would be impossible to state even a majority of the modern applications of the photoelectric cell in an article of this length. It is sufficient to say that its use enters the fields of chemistry, telephotography, and pyrometry, and can be found to play some part in nearly every branch of modern science and industry.



Phhotoelectric relay used to count finished relays on assembly line.

Photo Courtesy General Electric

STEAM GENERATOR

(*Continued from Page* 9)

boilers. It may be designed for all pressures up to the critical pressure.

Velox

While the Velox boiler does not operate at extremely high pressures units have been designed for over 1100 psi. steam pressure and higher pressure seem to be entirely practical. The combustion space operates under a pressure of 30-40 psi. which permits an extremely high heat release of over 800,000 B.T.U. per cu. ft. per hr. This pressure is produced economically by the use of an exhaust-gas-turbine-driven compressor. Operating under pressure permits almost perfect combustion and excess air can be reduced to about 10%. The hot gases leave the combustion space at 700-1200 fps. velocity and flow past the boiler water. Then they are used to operate the turbine and finally pass to an economizer which they leave at about 200° F. The power which is lost in the hot gases is made up in some installations by an electric motor. This is effected by mounting turbine, compressor, motor, fuel pump, and circulating pump on the same shaft and permits accurate control by merely varying the speed of the motor. The water is circulated around the combustion gases by the circulating pump with a ratio of about ten, which permits poorer water to be used. The water and steam are separated by a centrifugal separator and the steam is superheated. High efficiencies may be obtained and starting times are very short, even less than that of the Benson. Due to the high velocity of the gases and the tremendous heat exchange Velox boilers are very compact. Precision construction, however, demands a high original cost.

MISHAP

(*Continued from Page* 13)

I carried my left arm in a sling, that left the doctor's dinner table bare I imagine, for two weeks. I refrained from servile work as per usual. That's about all there is to tell. The next time you are telling someone of your latest mishap, remember how boring reading my tale of woe was, and spare them brother, spare them.

CAMPUS SURVEY

(*Continued from Page* 16)

out, and the sophomores proceeded to teach the freshmen a new kind of religion. This gathering was overseen by a number of juniors and seniors who saw that everything proceeded as it should. After these ceremonies Rosie was taken back to her living quarters. Next the sophomores proceeded to the lake with a few freshmen to baptize them. The remainder of the freshman class followed, and on the shores of the lake the freshmen and sophomores really met for the first time. As a result some freshmen and sophomores had a bath on Friday instead of the conventional Saturday. The seniors enjoyed this entertainment very much and did all that they could to keep it from ending. The only mishap that took place was that some of the freshmen lost their hats, but these were replaced by new ones which the bookstore gladly sold to the hatless freshmen.

ALUMNI NEWS

(*Continued from Page* 18)

'43 Feb. Edward E. Richardson, e.e.

Oct. Vinton B. Haas, e.e.

'44 July William S. Mitchell, m.e.

x-'44 Harmon L. Shaw, Robert A. Greger, Arthur Marshall.

x-'45 George Kyle

August

'30 Carl E. Ehrenhardt, e.e., with honors.

'43 Oct. Robert D. Calvert, e.e.

'44 July William R. Colclesser, c.e., Frank W. Guthrie, m.e., Robert G. Larkin, m.e.

x-'44 C. Phillip Bowne, Charles W. Newlin, William P. Woolsey, Jean R. Boatman, Marshall W. Roesch, Rex E. Blood, Carl R. Wodicka, Kenneth W. Barker.

x-'45 Max E. Lindley, William G. White.

CARBON DIOXIDE

(*Continued from Page* 5)

Other absorbing solutions may be used, but the sodium and potassium carbonates are used because of their absorbing capacity. Potassium carbonate is favored over sodium because its bicarbonate is more soluble than the corresponding sodium compound. The temperature of this lye or slurry is held between 30°-40° C.; therefore special water coolers are required. It is only fair to say, at this time, that there are some other absorbents which are as effective as the alkali carbonates but are not generally used because of their cost or other factors. One of these is sodium hydroxide.

Inside the absorbers the carbon dioxide converts the alkali carbonate into alkali bicarbonate. $Na_2CO_3 + CO_2 + H_2O \rightarrow 2NaHCO_3$. Much of the carbon dioxide is lost in the absorbers, which is one of the chief disadvantages of this process. The gas entering the absorbers is 17 per cent carbon dioxide, and 8-9 per cent is lost or over 50 per cent of carbon dioxide available. To decrease this loss four large absorbers are usually used, two of which are in series.

The main problem confronting the plant manager or engineer is to keep the absorbing unit at peak capacity. The efficiency of the whole plant depends upon the rate of absorption of the gas in the absorbing towers. Many factors affect the rate of absorption—the type of absorbent used, the temperature of the "lye", velocity of the gas and "lye" in the absorbers, and the purity and concentration of the "lye".

The liquid bicarbonate from the absorbing towers is passed into a lye boiler, where the carbon dioxide is liberated by boiling. This operation is the reverse of the reaction in the absorbers. $NaHCO_3$ (212° F.) $\rightarrow Na_2CO_3 + CO_2\ H_2O$. The regenerater carbonate, now called "weak lye" because of its loss of carbon dioxide, is returned to the absorbers for reabsorbing. The gas is cooled and sent to a gasometer.

The carbon dioxide at this point is 99.8 per cent pure, but contains water vapor and often an undesirable

Names, addresses and telephone numbers of all the bridesmaids.

Cut Courtesy Westinghouse

foreign odor, which is due to certain oxidizable organic substances. In this case the gas is scrubbed with potassium permanganate for removal of odors.

The water is removed from the carbon dioxide by first cooling and then absorption by calcium chloride, silica, or alumina gel or condensation by means of refrigeration. Calcium chloride is probably the most important chemical dehydrator, but silica gel absorption is used much more effectively in the case of carbon dioxide.

The final step in the manufacture of carbon dioxide is the liquefaction of the clean and dry gas. The liquefaction takes place only a little below the critical temperature (31° C.). Most gases used for commercial purposes have much higher critical temperatures; therefore the liquefaction of carbon dioxide presents no major problem.

The standard process is simple to operate; however the original investment is large per ton of carbon dioxide produced, and the absorption efficiency, even at its best, is not over 50 per cent. Every pound of carbon dioxide produced requires 12 gallons of strong "lye" and 10 to 12 pounds of water must be evaporated.

The Reich Process

Gustave T. Reich, attempting to overcome the defects of the standard absorption process and yet use an inexpensive alkali carbonate for the absorbent, has perfected the Reich absorption process. In this process a saturated solution of alkali bicarbonate and carbonate are in the absorbers instead of the "lye" solution as used in the standard process.

Steam-driven agitators are placed in the absorption towers and a much more concentrated "lye" or slurry solution is used. This not only eliminates the cost of high grade coke, but also speeds up the rate of absorption. When carbon dioxide is passed up through the absorbing towers, a large amount of solid alkali bicarbonate is formed.

This solid precipitate (alkali bicarbonate) is carried along in suspension with the rest of the slurry from the absorber into the preheater. From here the slurry passes into the dissociater where the carbon dioxide is liberated and the sodium carbonate goes into solution and is used again in the absorbers. The gas is purified, compressed, and condensed as in the standard process.

Only one gallon of slurry is needed for each pound of carbon dioxide produced by the Reich process as compared with 12 gallons of "lye" by the standard process. Only one gallon of water must be evaporated for pound of carbon dioxide, and the product is of the same purity as in the standard process.

This process has many other advantages over the standard process. In the first place, gases with much

(*Continued on Page* 26)

CARBON DIOXIDE

(*Continued from Page* 24)

lower carbondioxide concentration (12-14 per cent) may be used. Only 2 per cent of the gas is lost in the absorbers as compared to 8-9 per cent in the standard process. The handling of solid bicarbonate, however, is mechanically difficult and expensive. The apparatus is more expensive, and in order to maintain a high efficiency the liquid in the dissociater should be kept saturated with alkali bicarbonate.

Fermentation CO_2

One modification of the Reich process is sometimes used in purifying carbon dioxide recovered from fermentation processes. The gas is usually very pure and needs not to be absorbed in an alkali "lye" or slurry. Instead it is passed a series of scrubbers to remove undesirable odors and substances, and then it is compressed in two stages.

The gas is first passed through an alcohol scrubber and two water scrubbers. It is then dehydrated and sent to a compressor where initial compression of 75 pounds takes place. The carbon dioxide is next passed through a series of four scrubbers. The first contains bichromate, the second concentrated sulfuric acid, the third sodium carbonate, and the fourth oil. After passing through these scrubbers, the pure carbon dioxide is then sent back to the compressor for final compression. Here the gas is compressed to 400 pounds and sent to the condensers.

Comparison of Standard Absorption Process and Reich Process

(Based on production of 2000 lb. CO_2 per hour from flue gas containing 14 per cent CO_2.)

	Standard Absorption Process	*Reich Process*
Per cent CO_2 in flue gas	14	14
Per cent CO_2 in exit gas	8.4	2.0
Per cent CO_2 absorbed	40.0	85.7
Flue gas flow, cu. ft. per min.	5,145.0	2,375.0
Number of absorbers	4	2
Size of absorbers in feet	10x100	6x20x10
Absorption Space, gal.	235,000	18,000
Absorption Space, cu. ft.	31,000	2,400
Na_2O per cu. ft., lb.	4.1-4.7	14.6-17.5
"Weak Lye" per min. to absorber, gal.	1,600	150
"Strong lye" or slurry per min. to dissociator, gal.	400	33
Dissociator heating surface sq. ft.	1,300*	300
Absorber temp., deg. F.	120	120
Dissociator temp., deg. F.	260*	220
Water evaporated, lb. per hr.	20,000	2,000

*Applies also to lime kiln and coke gas.

Courtesy Reich, Chem. and Met.

RESEARCH

(*Continued from Page* 20)

ciently than the previous splash method.

New metal. To cope with the recent aluminum shortage without materially increasing the weight, the compressor casing was changed from cast aluminum to pressed steel.

New Process. Previously small "buckets" or blades, of spinning wheels in the turbo, were forged and machined. Now metal is poured into moulds, similar to those used in casting dental plates, and compressed under heat with a mass-production precision which eliminates machining.

Welding. By flash-welding wheels to shafts and simplifying design of other parts to facilitate production-line welding, considerable time has been saved.

Manufacturing methods. Long, tedious hand methods were circumvented by revamping milling techniques so that many operations now require minutes rather than hours. Balancing, assembling and testing have undergone widespread changes in simplification of operations, permitting less skilled workers new to industry to participate on a large scale.

Perhaps the most spectacluar battle application of turbosuperchargers is on the B-29. The basic function of this plane's eight turbos is to feed enough oxygen into the four 2200 horsepower engines to take it to undisclosed heights above enemy flak. The turbos on two of the engines also pressurize the cabin, enabling members of the crew to operate without oxygen masks, which they use only during bombing runs or in emergencies. The peace-time Boeing Stratoliner used separate cabin superchargers for this same purpose, but the B-29 is the first plane to use the engine's turbos for pressurization.

War Workers' Suggestions Help Meet Production Goals

Americans are the "tinkeringest" people in the world. Just turn over a piece of machinery to a curious Yankee mechanic—he'll examine it, take it apart, put it together, discover why it "ticks" and sooner or later come up with an idea to make it function more efficiently.

Recently, for example, an automotive company encountered difficulty in the manufacture of fuel injectors for Diesel engines. In cleaning tiny holes in the unit, pieces of piano wire were tried, but results were unsatisfactory.

While cleaning his pipe one evening at home a plant supervisor hit upon the idea of using pipe cleaners to do the bothersome job. He tried them the next day and they worked well. As a result the company has been using ordinary pipe cleaners in a standard manufacturing operation ever since.

Before the company could set up the new operation, however, a way had to be found to buy pipe cleaners. At first, the supervisor sent his children to all the stores in the neighborhood without success. Finally, the Navy, after detailing officers to investigate, approved a priority under which the plant now buys the cleaners.

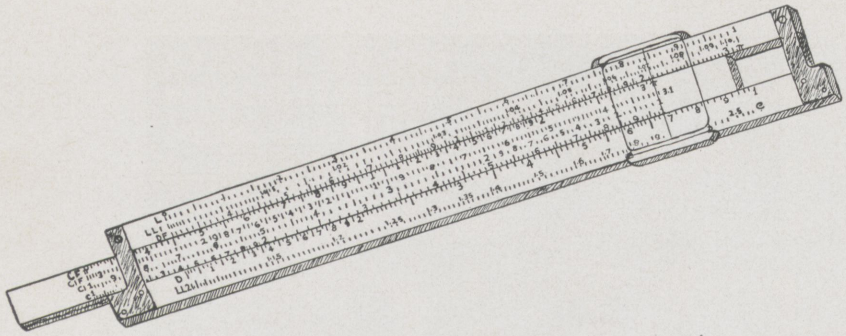
Further concrete evidence that this tinkering trait has paid handsome dividends to the Nation's war production program is found in the engineering records of many automotive companies. These show that workers on all phases of production have contributed to the industry thousands of ideas, or suggestions, to increase deliveries of war goods, improve quality, reduce costs or save materials.

Although some companies had sponsored suggestion plans before the war whereby an employee was paid for a practical production idea, the need for large quantities of war material following Pearl Harbor intensified the programs throughout the industry.

One company reports that during 1943, approximately 20 per cent of all the ideas submitted by their employees were found practical. From a total of 125,000 suggestions, some 25,000 were put to work on war production, earning for their contributors awards in War Bonds amounting to nearly a million dollars.

The War Production Board recently cited three employees of an automotive company for a series of suggestions which resulted in the saving of 15,530 man-hours a year on the production of Army carbines. In addition, the ideas increased the number of guns delivered each day and will ultimately effect a saving of 250,000 rounds of ammunition for the Army.

As one automotive executive puts it: "It's pooling the thinking of the janitor and the general manager and everyone in between that gets the job done."



Sly Droolings

Edited by JOHN R. LEE, soph., m.e.

Girls, when they went out to swim,
Once dressed like Mother Hubbard.
Now, they have a bolder whim;
They dress more like her cupboard.

Aphrodite is a germ which causes sickness.

Trigonomity is when a lady marries three at the same time.

Gravitation is that if there were none, we should fly away.

Inertia is the ability to rest.

A dynamo is a machine that makes dynamite and other explosions.

"What is your objection to birth control?"

"That your parents didn't make it work!"

Then there's the determined gal who feels she's got to maintain a good front—or bust.

Glamor is something that evaporates when the sweater is a little too large.

I. S. T. C. coed: "Do you know what they're saying about me?"

ASTRP: "Sure, that's why I came over."

Matrimony is a place where souls suffer for a time on account of their sins.

A skeleton is a man with his inside out and his outside off.

Chlorine gas is very injurious to the human body, and the following experiment should, therefore, only be performed on the teacher.

A magnet is a thing you find in a bad apple.

Water is composed of two gins, Oxygin and Hydrogin. Oxygin is pure gin, Hydrogin is gin and water.

A therm is a germ that creeps into the gas meter and causes rapid consumption.

How many wars were waged against Spain?

Six.

Enumerate them.

One, two, three, four, five, six.

There are two methods of becoming an American—to be born one—to be neutralized.

Give King Alfred's views on modern life had he been alive today.

If Alfred had survived to the present day he would be such an exceedingly old man that his views on any subject would be quite worthless.

The two genders are masculine and feminine. The masculines are divided into temperate and intemperate and feminines into frigid and torrid.

Chemists have found a way to make synthetic milk but the majority of the population prefer it the udder way.

A liter is a nest of young puppies.

A monologue is a conversation between two people, such as husband and wife.

Gravity was discovered by Isaac Walton. It is chiefly noticeable in the autumn, when the apples are falling off the trees.

A spinster is a bachelor's wife.

Chivalry is the act of a man who gives his seat to a lady in a public convenience.

Purgtory—a place where those go who are too good to go to heaven and too bad to go to hell.

A cat is a quadruped, the legs, as usual, being at the four corners.

Artist: "I'd like to hire that dancer to pose for my next painting."

Friend: "I thought you were an animal painter?"

Artist: "I am, and she's the one to bring out the beast in me."

Name four breeds of pigs.

Black pig, white pig, black and white pig, and brown pig.

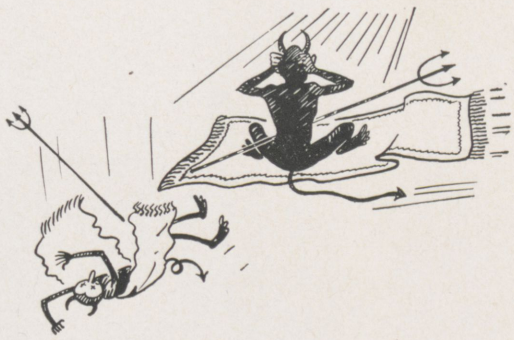
Explain the effect of heat and cold and give illustrations.

Heat expands: in summer the days are longer.

Cold contracts: in the winter the days are short.

Campus News

RESEARCH AND ENGINEERING KEEP GENERAL ELECTRIC YEARS AHEAD



DEATH RAY FOR GERMS

MANY germs use air invasion tactics. They float through the air on dust particles until they reach a potential victim. And then they attack. A sneeze or a cough in a crowded classroom may start a veritable epidemic of colds, measles, or some other contagious disease.

Now a new ultra-violet lamp, the General Electric germicidal lamp, promises relief to harassed school teachers, and death to many air borne germs. The lamp looks like an ordinary fluorescent lamp. However it produces germicidal rays instead of light rays. A special glass permits the passage of the germicidal energy produced by electric current passing through mercury vapor.

While complete freedom from communicable diseases isn't likely to result from the use of these lamps, they will help. During a recent epidemic only one out of eight children in a classroom where germicidal units were installed contracted the disease as compared to over half in the umprotected rooms.

PROCESS TIMER

ALMOST everyone is familiar with the timing gadget that will shut off the oven. Few have ever heard of another timing device which can direct as many as 75 accurately timed operations.

A new G-E two-dial rotary-type process timer does just that. It is designed for use in chemical industries which produce such things as hi-octane gasoline, toluene, and butadiene. The catalytic processes required in their manufacture call for precise timing and numerous safety precautions. The process timer acts as a many-handed, omniscient selector. Once it is set, the possibility of human error disappears.

BAZOOKA

BAZOOKA—the name means music (of sorts) to some, valuable military material to others. The origin of the nickname is common knowledge, the origin of the gun itself has been disclosed only recently.

The first Bazookas were officially known as "Launcher, Rocket, AT, M-1." In May of 1942 the Army gave G.E. an order to design, develop, and produce a large number of the units within thirty days. The whole job was completed, with 89 minutes to spare.

Since that time many Bazookas have come off the G-E assembly lines, to aid Allied fighting men in destroying enemy tanks. *General Electric Co., Schenectady, New York.*

Hear the General Electric programs: "The G-E All-girl Orchestra" Sunday 10 p.m. EWT, NBC—"The World Today" news, every weekday 6:45 p.m. EWT, CBS.

The best investment in the world is in this country's future. Keep all the Bonds You Buy.

GENERAL ELECTRIC

953-92-211

YOU'LL ENJOY BING CROSBY IN "GOING MY WAY"... HIS LATEST PARAMOUNT PICTURE
"There's no friend like an old friend...and that's how I've felt about Chesterfield ever since I first sang for them several years ago"
Bing Crosby
Chesterfield
For my Friends and Guests...
IT'S CHESTERFIELD
Yes Sir.. Millions know Chesterfields always Satisfy... They're Cooler, Milder and Better-Tasting. More smokers are finding this out every day... so next time, do justice to your taste... ask for Chesterfield's RIGHT COMBINATION WORLD'S BEST TOBACCOS
Chesterfield
CIGARETTES
LIGGETT & MYERS TOBACCO CO.
CHESTERFIELD